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Littleleaf Disease

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Littleleaf disease is the most serious disease of shortleaf pine in the Southern United States. Affected trees have reduced growth rates and usually die within 6 years.

The disease is caused by a complex of factors including the fungus *Phytophthora cinnamomi* Rands, low soil nitrogen, and poor internal soil drainage. Often, microscopic roundworms called nematodes and species of the fungal genus *Pythium* are associated with the disease.

Affected stands are found in the Piedmont area from Virginia to Mississippi, with additional scattered pockets of the disease in eastern Tennessee and southeastern Kentucky (fig. 1). The disease has its greatest impact in Alabama, Georgia, and South Carolina.

In the most recent general survey, littleleaf disease was found over 35 percent of the commercial range of shortleaf pine and was severe enough to be a factor in timber management on about 1.4 million forested acres. Losses attributed to littleleaf exceed $15 million per year.

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Shortleaf pine is the most seriously damaged host, with loblolly pine damaged to a lesser extent. Littleleaf disease has also been reported on Virginia, pitch, slash, and longleaf pines.

Symptoms

The first symptoms of littleleaf disease are those of nutrient deficiency: a slight yellowing and shortening of the needles and reduction of shoot growth.

In the later stages of the disease, the symptoms become progressively more distinctive. The crown of an infected tree appears thin and tufted: New needles are discolored and shorter than normal, and the tree loses all but the

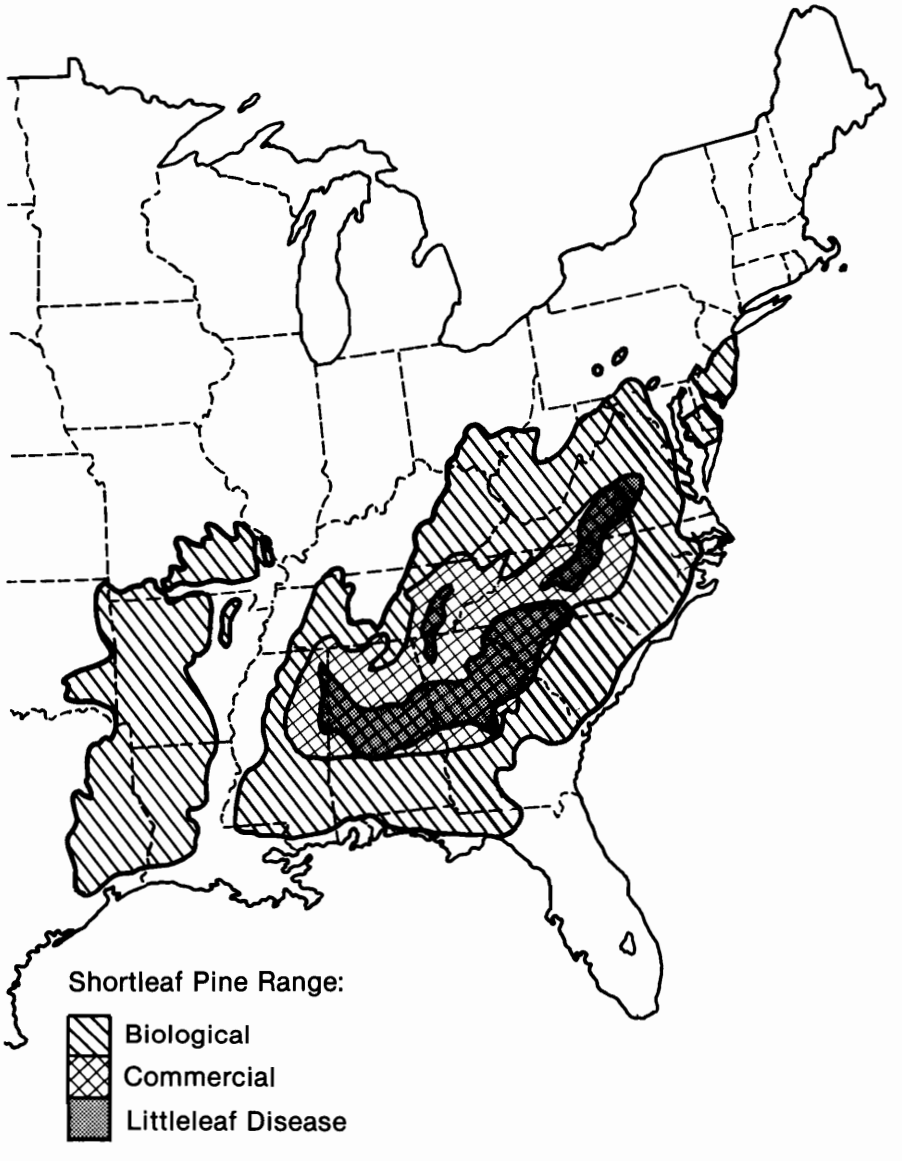

Figure 1—*Known distribution of littleleaf disease within the biological and commercial ranges of shortleaf pine, its most seriously damaged host.*

new needles near the tips of the branches (fig. 2). Branches begin dying, starting in the lower crown and progressing upward through the crown (fig. 3). During this time, the tree's diameter growth is markedly reduced.

About 3 years before death, diseased trees commonly produce abundant crops of small cones. Most of the seeds in these cones are sterile. Littleleaf-killed trees can often be recognized by these undersized cones, which remain attached to the branches. (See cover.)

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Figure 2—*Healthy (left) and littleleaf-infected (right) shortleaf pine. The crown of the diseased tree appears thin and tufted.*

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Figure 3—*Littleleaf-infected tree showing typical disease symptoms. The crown looks thin, tufted, and off-color; and the branches are dying.*

Disease Biology

Littleleaf disease rarely occurs in younger trees less than 20 years old and becomes increasingly severe in older stands. Some diseased trees die within the year after the first noticeable symptoms appear, while others live for 12 or more years. The average tree, however, dies about 6 years after the first symptoms appear.

Phytophthora cinnamomi, which causes the disease, infects the rootlets of susceptible trees. Where the soil is characterized by low nitrogen and poor internal drainage, the disease results in rootlet mortality. The effects of the disease are often made worse by the activity of nematodes and species of the fungal genus, *Pythium*, which also attack the rootlets.

Phytophthora cinnamomi is common in soils in the Southeast. It has been isolated from dead roots of outwardly healthy shortleaf pines, so vigorously growing trees can apparently overcome the root damage it causes. However, when soil conditions are bad enough to cause low vigor in trees, their root systems deteriorate faster than new rootlets form, and the trees slowly starve, causing the symptoms of nutrient deficiency that are the first indication of littleleaf disease.

Spores of *Phytophthora cinnamomi* are mobile, but their mobility is influenced by the soil's internal drainage. On sites with normally high soil moisture, the disease is favored. On sites with well-drained soils, the movement of spores is restricted.

Hazard Rating

To hazard rate forested areas, simply observe the condition of the pine. If littleleaf disease is present, the area is a high-hazard site for the next tree crop.

Copeland and Campbell (1954) present a very reliable method of hazard rating sites that are not currently supporting shortleaf or loblolly pines (table 1). This method is useful in areas where type conversion or old-field reclamation is planned. It is based on measurements that are easily made in the field. The soil characteristics evaluated in this system are degree of erosion and internal drainage (three subevaluations: subsoil consistency (when moist), depth to zone of greatly reduced permeability, and subsoil mottling).

These four characteristics are rated numerically and the scores totaled. High-hazard sites score 0 to 50 points; moderate-hazard soils score 51 to 74 points; and low-hazard soils score 75 to 100 points.

Management Alternatives

On sites where hazard is low (no littleleaf present in an established stand or hazard rating of soil shows low hazard for littleleaf disease), land managers need not consider the disease; and normal management of pine will be possible.

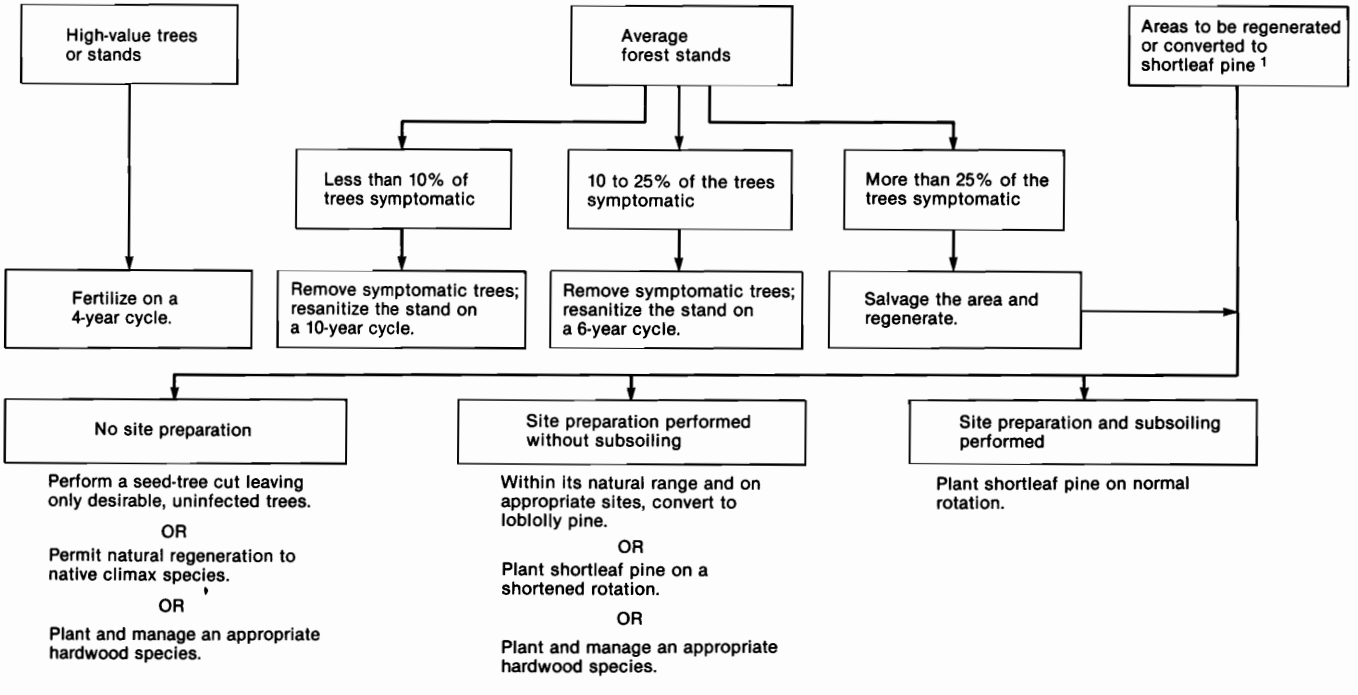
Where the disease is present or the hazard is high for littleleaf, preventive or control measures should be taken.

A set of effective management recommendations has been developed for use in high-hazard areas — areas where littleleaf has been or is expected to be a problem. These recommendations have been incorporated into a decision key to aid in selecting appropriate management strategies (fig. 4).

Table 1—*Numerical system for field rating sites for littleleaf disease hazard based on soil characteristics (Campbell and Copeland, 1954).*[1]

Soil characteristics	Rating
Erosion	
Slight—Depth of A horizon not seriously changed, less than 25% removed	40
Moderate—25–75% of A horizon lost, shallow gullies may be present	30
Severe—All of A horizon lost, often some of B gone, shallow gullies common	20
Rough gullied land—Soil profile has been destroyed except in small areas between gullies	10
Internal drainage	
Subsoil consistency (when moist)	
Very friable—Crushes under gentle pressure, coheres when pressed	32
Friable—Crushes under gentle to moderate pressure, coheres when pressed	24
Firm—Crushes with moderate pressure, but resists	16
Very firm—Crushes under strong pressure, barely crushes between thumb and forefinger	8
Extremely firm—Cannot be crushed between thumb and forefinger	0
Depth to zone of greatly reduced permeability	
24–36 inches (61–90 cm)	15
18–23 inches (46–60 cm)	12
12–17 inches (30–45 cm)	9
6–11 inches (15–29 cm)	3
Subsoil mottling (grays and browns)	
None	13
Slight	9
Moderate	5
Strong	1

[1] High-hazard soils score 0 to 50 points; moderate-hazard soils score 51 to 74 points; and low-hazard soils score 75 to 100 points.


High-value trees or stands
Average forest stands
Areas to be regenerated or converted to shortleaf pine 1
Less than 10% of trees symptomatic
10 to 25% of the trees symptomatic
More than 25% of the trees symptomatic
Fertilize on a 4-year cycle.
Remove symptomatic trees; resanitize the stand on a 10-year cycle.
Remove symptomatic trees; resanitize the stand on a 6-year cycle.
Salvage the area and regenerate.
No site preparation
Site preparation performed without subsoiling
Site preparation and subsoiling performed
Perform a seed-tree cut leaving only desirable, uninfected trees.
OR
Permit natural regeneration to native climax species.
OR
Plant and manage an appropriate hardwood species.
Within its natural range and on appropriate sites, convert to loblolly pine.
OR
Plant shortleaf pine on a shortened rotation.
OR
Plant and manage an appropriate hardwood species.
Plant shortleaf pine on normal rotation.

[1]On these areas, consider interplanting with a legume such as *Robinia* or *Lespedeza*.

Figure 4—***Management options to prevent or reduce losses from littleleaf disease in high-hazard areas.***

Prevention is accomplished through species manipulation or site rehabilitation.

Planting resistant species, such as hardwoods or nonsusceptible pines, will avoid the problem of littleleaf disease. If shortleaf pine is still desired in an area where the current stand shows littleleaf disease symptoms, the best uninfected trees should be left as seed trees to confer some resistance to the next stand.

The main site rehabilitation technique for use with littleleaf is breaking up any of the bricklike, extremely compact layer of clay (hardpan) present in the soil. This technique permits better drainage on the site, thus reducing the spread of the fungus.

Interplanting or seeding a regeneration area with a legume, such as a species in the genus *Robinia* or *Lespedeza*, will produce a short-term increase in available soil nitrogen.

Control can be achieved in two ways: by tree removal or by fertilization. The removal of infected trees is undertaken primarily to minimize the volume of timber lost when a tree becomes diseased.

One ton of 5–10–5 fertilizer plus one-half ton of ammonium sulfate per acre can be used for high-value trees or ornamentals. Occasionally, fertilization is used to boost a forest stand into the next higher value class, for example, from pulpwood to pole. Fertilization will delay the development of symptoms for about 4 years. Trees can appear to recover since the needles produced during this period will be very close to normal in color and size.

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